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Metal- γ -irradiated Nanoparticles for Detection of Carbohydrate Antigen 15 α in Human Serum Using a Sandwich-Type ICP-MS Immunoassay

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Abstract

This work presents a method to determine carbohydrate antigen 15f (CA15f) in serum using sandwich-type inductively coupled plasma-mass spectrometry immunoassay. For this, Cd, Cs-doped magnetic nanoparticles (MNPs) for

target extraction and ratiometric measurement to enhance the calibration linearity were synthesized by co-precipitation, of which the size was in the size range of 21–24 nm. The numbers of doped Cd and Cs atoms were in the range of 2.5–3.5 per MNP. The new synthetic method simplifies the synthetic procedure significantly with high flexibility for doping. Rare earth metal-doped silica NPs (SNPs), *i.e.*, Gd, Eu, or Ce, were also synthesized for detection through metal-chelation and microemulsion method, with a final size range of 70–85 nm. For application, carbohydrate antigen 15 (CA15) was spiked into a human serum and determined by the sandwich-type ICP-MS immunoassay using the synthesized nanoparticles after blank subtraction. The obtained limit of detection (LoD) without any sample treatment was 2.70 $\times 10^{-4}$ U/mL, which was about 2.28 times better than that of enzyme-linked immunosorbent assay (ELISA).

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- Zhengru Liu, Bin Yang, Beibei Chen, Man He and Bin Hu, Upconversion nanoparticle as elemental tag for the determination of alpha-fetoprotein in human serum by inductively coupled plasma mass spectrometry, *The Analyst*, **142**, 1, (197), (2017).

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